Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Reserve
1.9
P772Ht

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils
and Agricultural Engineering

B. T. & S. Office Report No. 191

TRANSPORTATION TEST WITH WHITE ROSE POTATOES FROM KERN COUNTY, CALIFORNIA TO NEW YORK CITY, June, 1948

By

D. H. Dewey, Assistant Physiologist
W. T. Pentzer, Senior Physiologist
J. R. Clements, Scientific Aide
E. A. Friedman, Associate Pathologist

July 2, 1948
Beltsville, Maryland

LIBRARY
CURRENT SERIAL RECORD
SEP 10 1948
U.S. DEPARTMENT OF AGRICULTURE

TRANSPORTATION TEST WITH WHITE ROSE POTATOES FROM KERN COUNTY, CALIFORNIA TO NEW YORK CITY JUNE - 1948

This was the second transportation test made with new potatoes from Kern County, California during the 1948 season. The object of this test was to determine (1) the relative effectiveness of standard refrigeration and the various types of modified refrigeration now used in shipping potatoes from Kern County, California to eastern markets (2) the carrying quality of precooled and top-iced potatoes. In the first test, H. T. & S. No. 189 in May during moderately cool weather, initial ice with one re-icing in transit (Rule 247) proved to be adequate. There remained the question of whether or not a modified icing service would provide enough refrigeration during warmer weather such as normally would be encountered in late June.

The railroad protective services used are listed in Table 1. The cost of refrigeration from Bakersfield, California to New York City or Washington, D. C. ranged from $101.20 for standard refrigeration (cars 1 and 5) to $91.99 for Rule 247 (cars 2 and 4). Rule 254 (car 3) cost $69.31.

Precooling of the tubers shipped in car 4 under Rule 247 was done prior to grading, bagging and loading for shipment. The potatoes were submerged for approximately 20 minutes in a deep bulk-handling vat of water containing crushed ice. The temperature of the water was reduced to 35°F. before starting the precooling operation, and additional ice was supplied to maintain the water temperature in the range of 40-42°F. during the precooling period. The cost of precooling could not be determined accurately since an excess of ice was used. This method is not used commercially.

Car 6 was top-iced with 9,900 pounds of crushed ice following loading. The total cost, including top-ice and transportation charges under Rule 242 (top-ice) and Rule 240 (initial ice), was about the same as standard refrigeration to Chicago, Illinois, the destination of this car.

Test Cars

The refrigerator cars used in this test were the forty-foot end-bunker type with convertible ice tanks. All were of recent construction with steel roof and wall sheathing and all were equipped with air circulating fans (Preco), 7 1/2 inch floor racks and side-wall air ducts. The insulation of the walls, roof and floor was four inches thick.

Temperature and Icing Records

Commodity temperatures during the transit period were obtained by means of distant reading electric resistance thermometers inserted in the tubers. These temperatures were obtained at the following positions of

the head-end of the load: top, middle and bottom sacks of the bunker (first), quarterlength (sixth) and doorway (eleventh) sacks near the center-line of the car. In addition, air temperatures within the cars were obtained beneath the floor-racks, near the bottom bulkhead opening and above the load approximately eighteen inches from the top bulkhead opening, and at the doorway. Recording thermometers were also used at the top bunker openings of fan cars to record the air temperature continuously throughout the test period. A similar record of the outside air temperature was obtained with a recording thermometer attached to the underside of one of the cars.

The quantity of ice supplied was calculated either by counting the number of cakes used or by noting the height of the ice in the bunker immediately prior to icing. The latter method was employed to estimate the quantity of ice remaining at points en route and upon arrival of the cars at destination.

Loading

The loads were the same in all cars, consisting of 360 bags of potatoes, each weighing 101 pounds. These were "bump" loads, that is, loaded directly from hand trucks. The load was three bags wide and five bags high, laid horizontally and crosswise of the car. Each end of the cars contained eleven 3 x 5 stacks, and the remaining thirty bags were wedged four layers high in the doorway. The loads were in good order upon arrival and had settled three to five inches during transit.

The loading data for these cars are summarized in Table 2. All cars were loaded June 18 between 8:40 A.M. and 2:30 P.M. Cars 3 and 4 were pre-iced at Bakersfield 14 to 16 hours prior to loading and were delivered to the packing house with vents closed. The other cars were loaded without ice in the bunkers (dry). Three of these were shipped with vents open until initially iced (cars 1 and 2 at Bakersfield and car 5 at Fresno) and then with vents closed. The vents of car 6 were closed following loading and prior to top-icing of the load.

Loads

Detailed information concerning the potatoes loaded in the test cars is summarized in Table No. 3. The commercial loads were U. S. No. 1 washed tubers of the White Rose variety. With the exception of those loaded in car 6, the potatoes were well matured and only slightly skinned. The potatoes loaded into car 6 were fairly well matured and moderately to severely skinned. In all cases, the tubers were free from decay and practically free from surface browning, mechanical injury and greening.

Three fifty-pound bags of potatoes were placed on top of the load at the doorway in Cars 1, 2, 3, 4, and 5. These potatoes were well matured with about 10 percent of them showing approximately 10 percent of the surface skinned and the remainder free of skinning. They ranged from 3 to 15 ounces in weight per tuber, with approximately 65 percent of them weighing 6 ounces or more. Defects of these tubers amounted to 2.5 percent mechanical injury, and 1 percent greening. There was no decay and no surface browning but traces were found of Rhizoctonia, water checks and stem-end discoloration. The grade

was approximately 95 percent U. S. No. 1 quality.

The potatoes making up the test lots were harvested from the same field and were handled in a comparable manner except for those placed in Car 4. These were submerged in the precooling vat and cooled to an average temperature of 54°F., which was comparable to the temperature of the commercial load in this car.

The test packages of Car 5, standard refrigeration with fans off, were removed at Proviso Yards and placed in Car 4, which had a load temperature at that time similar to that in Car 5. This made possible a direct comparison of all test lots at New York City, even though Car 5 was diverted to Washington, D. C.

Weather and Route

The air temperature during loading ranged from 78° to 93°F. Warmer weather was encountered the first day in transit, the temperature reaching a maximum of 95°. The next four days were extremely cool, but seasonal weather prevailed after the fourth day en route. The mean outside temperature was 69.5° which was only 2.0° warmer than during the first trip.

The test cars were loaded June 18, assembled the morning of June 19 at Fresno, California and traveled together over the Southern Pacific, Union Pacific, and Chicago and Northwestern railroads to Proviso, Illinois. At this point, Car 5 was routed to Washington, D. C. via Pennsylvania R.R. Car 6 was consigned to Chicago, but was diverted to Indianapolis, Ind. The remaining four cars were accompanied via Erie R.R. to New York City, arriving in Croxton Yards, New Jersey at 6:00 A.M. June 27th (See Trip Log, Table 4).

RESULTS

Transit Temperatures

The field temperature of the potatoes was not as high as desired or anticipated for this test. The average commodity temperatures for cars 1 to 6 shortly after loading and as initially determined by resistance thermometer readings were respectively 62, 72, 70, 54, 72 and 69°F. Car 4 was cooled in ice water to 54° from an initial temperature of 71° and Car 1 had some benefit in cooling from water left in the bulk-handling vat. In general, the non-precooled potatoes ranged from approximately 68° to 74°, whereas if warmer weather had been encountered they might have been in the range of 85° to 90°.

The temperature records for the 6 cars are shown in figures 1 to 6.

Rules 200, 247 and 254, Fan Cars

Car 1, which was shipped under standard refrigeration shows the effect of air circulation. All layers of the load were kept at about the same temperature (figure 1). The potatoes warmed about 5° between loading and initial icing at Bakersfield. When the fans were operating, air temperatures

of about 35° were obtained at the top bulkhead opening. Car 2, another fan car, shipped under Rule 247, initially iced at Bakersfield after loading and reiced once in transit at Laramie, Wyoming, also had uniformly cool temperatures in all layers of the load (figure 2). This was also true for Car 3, a fan car, pre-iced, replenished at Bakersfield, and reiced at Laramie. A comparison of the average temperatures of these three cars (figure 7A) shows that Rule 200 (Standard refrigeration) and Rule 254 (Pre-iced, replenished, reiced once) gave almost identical temperatures and that Rule 247 (Initially iced, reiced once) gave temperatures about 4° higher for 3 days prior to icing at Laramie. This was of little importance however, since the temperatures were low enough for new potatoes. The ice in both of these cars (Cars 2 and 3, Rules 247 and 254) was nearly depleted when they were reiced at Laramie. Car 2 required 11,000 pounds and Car 3, 10,000 pounds, (Table 5). If the potatoes had been warmer when loaded or if warmer weather had been encountered in Nevada and Wyoming, the ice supply might have been exhausted before reaching Laramie. Under such conditions, earlier reicing might be desirable. These cars had respectively 2,500 and 3,300 pounds of ice left upon arrival at New York, amounts which proved to be sufficient to keep the load cool prior to unloading.

Ice Water Precooling

Car 4 was a pre-iced car loaded with potatoes cooled to an average temperature of 54°F. by submerging in ice water. The car was not iced until reaching Laramie, 4 days after loading. It required only 6,800 pounds of ice to fill the bunkers as compared with 11,000 and 10,000 pounds in non-precooled cars 2 and 3 respectively. Car 4 had very desirable temperatures for potatoes from time of loading until arrival (figure 4). There was about an 8° to 10° spread in temperature between bottom and top layers since the fans were not operated. However, the top layer potatoes were 50° by the second day and continued to cool during the next 3 days, then they remained nearly constant during the rest of the trip. The non-precooled standard refrigerated cars (cars 1 and 5) required 2 1/2 days to reach the temperature of the precooled car (figure 7B). During the first day after loading there was about 20° difference in temperature between precooled Car 4 and non-precooled Car 5.

Fans On, Fans Off

Forced air circulation from car fans resulted in uniformly low temperatures, as shown in the graphs for Cars 1, 2 and 3. Car 5 under standard refrigeration, but with fans off had a spread of 10° to 15° between top and bottom layers (figure 5) whereas Car 1 with the same refrigeration, but with fans on had only a degree or two spread in temperature (figure 1). These two cars are compared in figure 7B. The fan car had an average load temperature several degrees lower than the standard car, but both had temperatures lower than necessary for potatoes.

Top-icing, Rule 240 and Standard Refrigeration

Top-icing the load with about 10,000 pounds of crushed ice reduced the average temperature of the load from 69° to 50° in about 20 hours. The middle

layer cooled more slowly than the rest of the load (figure 6). Temperatures were more uniform in this car than in the other cars without air circulation. It was not initially iced until 36 hours after loading and it received no further icing in transit. The bunkers were still about half full when the car reached Clinton, Ia., about 4 hours out of Chicago. Cooling was somewhat faster in this car than in Car 5 shipped under standard refrigeration with fans off (figure 7C) and it was second to the car of ice-water cooled potatoes (Car 4) in temperature reduction. As indicated later, the wetness of the sacks from top icing was objected to by the trade. Fans were operated during the last day and a half this car was in transit in an unsuccessful attempt to dry off the load. About 800 pounds of top-ice remained at Laramie and 300 pounds at Chicago, 48 hours later.

Icing records

The icing records indicate that the one reicing in transit given Cars 2 and 3 at Laramie was probably the minimum limit for safe practice. These cars were almost out of ice at this time and likewise were low on ice upon arrival in New York (Table 5). Total ice consumption varied from 14,400 pounds in precooled Car 4 to 21,050 in Car 3. Car 1, which was fairly cool when loaded, required 18,350 pounds of ice. From this it was evident, as it was in the previous test, that the field heat in the potatoes when loaded is probably the largest factor in determining ice meltage in transit.

Condition of Potatoes

Inspections of the test lots of potatoes were made when the cars were unloaded and after holding two to three days at approximately 85°F. At neither time were differences apparent in the amount of decay, browning or greening that could be attributed to transit conditions. All lots were of good appearance and condition, and apparently had not changed in these respects subsequent to loading.

Potatoes of the commercial load of Car 4 from the top and bottom bunker positions were examined for browning and decay at unloading and after holding for two days at 85°F. At the latter inspection, the bottom bunker potatoes (35°) showed 4.9 percent of slight browning, primarily at bruises which occurred during loading and in transit, as compared with no browning of the top bunker potatoes. There was also slightly more decay in the bottom bunker potatoes than in those at the top bunker position (4.0 percent and 2.0 percent respectively). The difference may have been due to increased bruising, although a contributing factor may have been poor periderm formation because of the more rapid cooling of the bottom bunker potatoes. These differences were not apparent immediately following unloading.

Damage due to rubbing and shifting of the bags in transit was not serious in Car 4.

The top-iced potatoes of Car 6 were damp to wet in all parts of the load when inspected in Chicago. Although the potatoes were moderately to severely skinned at the time of loading, there was no appreciable amount of decay or browning upon arrival in Chicago. A bag of potatoes from the

second layer from the bottom of the load which were very wet, and one from the top layer, which were merely damp, were held at the laboratory in Chicago for 3 days at 75°F. Although the tubers from both positions were practically free of browning when re-examined, there was considerable difference in the amounts of decay. Those of the lower layer had 26 percent decay and those of the top layer 7 percent, which was primarily bacterial soft rot following transit bruising and other mechanical injuries. The relative importance of decay and browning in the marketing of new potatoes should be kept in mind at all times. Browning detracts from the appearance but decay destroys the potatoes.

It is likely that the excessive moisture on the tubers of the top-iced load was partly responsible for the quantity of decay which occurred in Car 6 in comparison to that in the other cars; however, these potatoes were less mature and possibly more susceptible to soft rot infection than those in the other cars. The difference in decay between layers within this car was apparently due to the combination of greater bruising and more moisture in the lower layer than in the top of the load.

In addition to favoring the development of decay moisture in the load due to top-icing caused leaching of the dye from the brand mark and a resultant staining of some tubers. The buyers were reluctant to accept potatoes in wet bags, except at a discount apparently because of past experience in which wetness was associated with large quantities of decay. The car was diverted to Indianapolis after removal of the test lots in Chicago.

Weight Loss of Tubers

The weights of the test packages of tubers carried at the top doorway position in five of the test cars as determined at time of loading, unloading and following a holding period of several days are summarized in Table 6. Upon arrival at market, small but significant differences in weight loss of these potatoes were evident. The relative amount of weight lost by the test bags in the different cars appears to be more closely correlated with the temperature of the tubers during the first three days in transit than with the use of fans. The average tuber temperatures in the top doorway bags for the first three days were Car 4 - 52.7°F, Car 1 - 55.6°, Car 3 - 56.9°, Car 2 - 60.0°, and Car 5 - 66.5°. The weight loss was lowest at the lowest temperature and increased as the temperatures increased.

Although differences in weight loss between cars existed on arrival of the potatoes at market, they need not be considered of serious consequence since they became equalized after the tubers were held for two to three days at approximately 85°F. The weight loss then ranged from only 2.1 to 2.9 percent of the total weight at time of loading.

Commercial Considerations

No final conclusions are being drawn from the results of this test and this is to be regarded as a preliminary report. The temperature records and the inspection of the potatoes indicated that standard refrigeration, Rule 247 and Rule 254 all gave satisfactory delivery. The temperature of

the potatoes in all cars was lower than is normally considered necessary for the transportation of new potatoes. From a practical standpoint, refrigeration methods that would assure load temperatures no higher and only slightly lower than 50°F., would provide safe transit conditions with considerable savings in ice and car handling. The results of this test indicate that icing at every icing station is not necessary to maintain a temperature of approximately 50°.

Potatoes cooled in ice water and loaded in a preiced car which was reiced once in transit (Car 4) arrived in satisfactory condition and used 1/3 less ice en route than warm potatoes loaded in a car that was not preiced and was reiced once in transit (Car 2). The larger amount of ice remaining in the bunkers of Car 4 at the reicing station and destination provided an added margin of safety from running out of ice en route.

Top-icing seemed to be of questionable advisability because of the undesirable wetness of the sacks which caused buyer resistance. Of even more importance, it resulted in a humid atmosphere within the bag that favored decay after the potatoes were removed from the car.

Fan cars gave very uniform temperatures as in previous tests. No wilting or browning of the potatoes resulted from the forced circulation of air by the fans.

In spite of a fairly wide spread in temperature between potatoes of the top and bottom layers in non-fan cars, differences in the arrival condition of the tubers cannot be attributed to this spread. Loading and transit injury in the form of bruising seemed to be more important.

Except in Car 6, the potatoes shipped in this test were more mature than in the earlier test in May, and skinning, browning and decay were of little consequence. Those loaded in Car 5 showed considerably more skinning than those in Cars 1 to 4.

Weight losses of the tubers in transit were small and appeared to be related to the tuber temperatures during the early part of the trip. The least loss (1 percent) occurred in the precooled potatoes which had the lowest average temperature at the top doorway position during the first three days in transit (Car 4); the greatest loss (1.9 percent) was in the non-fan standard refrigeration car (Car 5), which had the highest average temperature at this position during the first three days. Severely skinned stock in the previous test lost 1.3 to 3.4 percent weight in transit, depending upon the transit temperatures.

Acknowledgements

Grateful acknowledgement is accorded to the following, whose cooperation and help made this transportation test possible.

The growers, packers and shippers who loaded the test cars.

Sid E. Carmine, Executive Secretary-Manager of the Kern County Potato Growers Association, Bakersfield, California

William R. Barger of the U. S. Department of Agriculture, Fresno, California.

C. W. Terrill, George Hammil and C. D. O'Bell of the Pacific Fruit Express Company

M. A. Lindsay, Farm Advisor and Dave Wright, Assistant Farm Advisor of Kern County, California.

I. I. Morris and H. K. Pratt of the Division of Truck Crops, University of California, Davis, California.

Richard Mantle, Pacific Railway Equipment Company

J. S. Blunt, J. Kaufman, W. A. Radspinner and E. Hruschka, U. S. Department of Agriculture, New York, New York.

G. E. Ramsey, U. S. Department of Agriculture, Chicago, Illinois.

R. C. Wright, U. S. Department of Agriculture, Beltsville, Maryland

For the facilities and courteous cooperation extended, special acknowledgement is made to:

Southern Pacific Railroad

Union Pacific Railroad

Chicago and Northwestern Railroad

Erie Railroad

also, to K. V. Plummer General Manager, Pacific Fruit Express Company for assistance in making necessary arrangements with the western lines.

TABLE 1.

LIST OF TEST CARS

Car	P.F.E.	Refrigeration	Rule	Shipper
1	5520	Dry car loaded; vents open to Bakersfield; standard refrigeration, vents closed Bakersfield to destination. Fans on.	200	F. H. Vahlsing
2	7487	Dry car loaded; vents open to Bakersfield; initial ice and vents closed at Bakersfield; re-ice at Laramie. Fans on.	247	F. H. Vahlsing
3	6928	Car pre-iced and vents closed prior to loading; replenished at Bakersfield; re-iced at Laramie. Fans on.	254	F. H. Vahlsing
4	6062	Car pre-iced and vents closed prior to loading; load pre-cooled; re-iced at Laramie. Fans off.	247	F. H. Vahlsing
5	7203	Dry car loaded; vents open to Fresno; standard refrigeration, vents closed , Fresno to destination. Fans off. (Destination Washington, D. C. via Penna. R. R. from Chicago)	200	Easwest Produce Co.
6	7764	Dry car loaded; top-iced with 9,000 lbs. crushed ice; vents closed to destination; initial icing at Roseville. Fans off. (Destination Chicago, Ill.)	242 and 240	Hoak Packing Company

TABLE 2

CAR LOADING AND SHIPPING DATA

KERN COUNTY, CALIFORNIA POTATO TRANSPORTATION TEST - ? - 1948

BAKERSFIELD, CALIFORNIA TO NEW YORK CITY, JUNE 18-27, 1948 - SP, UP, CNW, ERIE R.R.

Test Car	1	2	3	4 1/	5 3/	6 4/
PFE	5520	7487	6928	6062	7203	7764
Fans	On	On	On	Off	Off	Off
Shipping Point	WIBLE	WIBLE	WIBLE	WIBLE	SACO	PIXLEY
Load	360	360	360	360	360	360
Bags	101 Lbs.	101 Lbs.	101 Lbs.	101 Lbs.	101 Lbs.	101 Lbs.
Billed Weight	36,360	36,360	36,360	36,360	36,360	36,360
Load	3 rows crosswise, 5 layers, 20 stacks with 30 bags placed at doorway					
Refrig. Rule	Standard	247	254	247	Standard	242 & 240
Refrig. Cost	$101.20	$61.99	$68.31	$61.99	$101.20	$53.77 plus top ice ($25)
Bunkers	Dry	Dry	Pre-iced	Pre-iced	Dry	Dry
Initial Ice	Bakersfield	Bakersfield	Replen.	- - -	Fresno	Roseville
Re-Ice	All stations	Laramie	Laramie	Laramie	All Stations	None
Vents Open To:	Bakersfield	Bakersfield	Closed	Closed	Fresno	Closed
Ice Level when loaded	- - -	- - -	Full	Full	- - -	- - -
Loading started	9:55 A.M.	10:45 A.M.	1:13 P.M.	8:40 A.M.	9:40 A.M.	1:20 P.M.
Loading finished	10:45 A.M.	11:40 A.M.	1:50 P.M.	9:20 A.M.	10:30 A.M.	2:30 P.M.
Temp. during loading.						
Potato °F.	67.9	71.8	73.5	59.2 2/	71.0	69.4
Outside °F.	80.0	78.0	89.0	79.0	80.0	93.0
Brand	Limestone	Limestone	Limestone	Limestone	Lucky Leaf	World's Famous

1/ Potatoes pre-cooled by shipper in cold water tank.

2/ Potato temperature 71.3°F. before cooling.

3/ Potatoes top-iced by shipper Destination Washington, D. C.

4/ Destination Chicago Potatoes top-iced by shipper.

TABLE 3

[illegible] - 2

[illegible], June 13-27, 1948.

Test or	1	2	3	4	5	6
Shed	Kettler	Kettler	Kettler	Kettler	Kettler	Hoak
Place	Wible	Wible	Wiole	Wible	Waco	Fixley
Grower	Reynold M. Kettler	Reynold M. Kettler	Reynold M. Kettler	Reynold M. Kettler	Richard Tandy	Hoak
Location	Wheeler Ridge	Wheeler Ridge	Wheeler Ridge	Wheeler Ridge	Waco	Fixley
Planting date	Febr. 10	Febr. 10	Febr. 10	Febr. 10	Febr. 20	Febr. 20-25
Water off, days	14	14	14	14	12	8
Field hauling	Bulk	Bulk	Bulk	Bulk	Bags	Bags
Picking bags	Canvas	Canvas	Canvas	Canvas	Canvas	Canvas
Master	Vat	Vat	Vat	Vat 1/	Flood	Flood
Chlorinated water	Yes	Yes	Yes	Yes	No	No
Wax	No	No	No	No	No	No
Pre-size belt	Wire	Wire	Wire	Wire	Wire	Wire
Skinning:						
% of lot	10	10	10	10	10	90
% of surface	10	10	10	10	25	30-50
Surface browning,	1	1	1	0.5	None	None
Mech. injury,	2	2	2	2	1	2.5
Decay	None	None	None	None	None	None
Greenet (Sunburn)	1	1	1	0.5	None	1

1/ Deep water vat cooled with crushed ice.

TABLE 4

TRIP LOG
CALIFORNIA POTATO TRANSPORTATION T SP 2 - 1948
BAKERSFIELD, CALIFORNIA TO NEW YORK CITY
JUNE 18-27, 1948
VIA SP, UP, C&NW, ERIE

June	Station	Arrive (CDST)	Depart	Temp.	Weather
18	California Loading Points	8:40AM-2:30PM		78-93	Clear
"	" " "	6:30PM		90	"
"	" " "	7:15PM		85	"
"	" " "	8:15PM		79	"
19	Fresno, California	9:30AM	12:45PM	80-84	"
"	Madera	1:30PM		90	"
	Merced	2:45PM		91	"
"	Hurl ck	3:45PM		95	"
"	Tobin	5:48PM	7:18PM	85-90	"
"	Silver Lake	8:40PM	9:18PM	76-77	"
"	Roseville	10:[illegible]PM	2:40AM	68-69	"
20	Colfax	4:[illegible]AM	[illegible]:20AM	57	High overcast
"	Emigrant Gap	7:15 AM	8:45AM	52-54	" "
"	Norden	10:[illegible]AM	11:20AM	58	Overcast
"	Andover	10:50AM	11:30AM	60	Cloudy
"	Truckee	11:35AM	11:55AM	63	Partly cloudy
"	Sparks, Nevada	12:[illegible]PM	3:15PM	68-71	Cloudy
"	En route	5:35PM		77	"
"	" "	6:10PM	6:45PM	67	Rain
"	Lovelock	7:18PM	7:25PM	66	Cloudy
"	Lilay	8:40PM	9:25PM	56	"
"	En route	11:[illegible]PM	11:30PM	56	Rain
21	Carlin	[illegible]:[illegible]AM	4:[illegible]AM	[illegible]	Cloudy
"	Wells	7:[illegible]AM	7:[illegible]AM	57	"
"	En route	8:25AM	8:35AM	60	"

June	Station	Arrive	Depart	Temp.	Weather
21	En route	6:25AM	8:35AM	50	Cloudy
"	Valley Pass	9:20AM	9:30AM	54	"
"	Montello	10:40AM	11:25AM	54	Rain
"	Jackson	12:20PM	12:27PM	63	Partly cloudy
"	Beppo	12:48PM	1:05PM	63	" "
"	En route	1:13PM	1:22PM	63	" "
"	Colin, Utah	3:00PM (MST)		66	Cloudy
"	Ogden	4:00PM	8:05PM	55-56	Rain
"	En route	9:40PM		48	Cloudy
"	En route	10:00PM		47	"
22	Green River, Wyoming	3:05AM	6:35AM	45	Overcast
"	Rock Springs	7:15AM	7:40AM	46	"
"	Bitter Creek	9:00AM	9:50AM	46	"
"	Rawlins	12:01PM	1:15PM	47	Rain
"	Hanna	2:15PM	2:38PM	45	"
"	Rock River	3:50PM	4:45PM	43	"
"	Laramie	6:30PM	8:10PM	45	Cloudy
"	Cheyenne	10:40PM	1:40AM	49	Rain
23	Sidney, Nebraska	4:40AM	5:30PM	63	Cloudy
"	North Platte	8:30AM (CST)			
			1:45PM	70	Partly cloudy
"	Gothenburg	2:01PM	2:11PM	78	Overcast
"	En route	3:15PM		84	Clear
"	Grand Island	4:15PM	5:00PM	83	Overcast
"	Central City	5:35PM		81	"
"	Council Bluffs, Iowa	8:00PM	11:30PM	69-73	Cloudy
24	Boone	4:50AM	6:45AM	64	"
"	En route	7:30AM		73	Clear

June	Station	Arrive	Depart	Temp. °F.	Weather
24	Marshalltown		6:35AM	71	Clear
"	Montour		9:30AM	83	"
"	Tama	9:45AM	10:00AM	87	"
"	Mount Vernon		12:30PM	89	"
"	Clinton	2:45PM	4:00PM	93	"
"	En route		5:00PM	92	"
"	Proviso, Illinois	7:[illegible]PM	8:00AM	71-75	"
25	Clearing	4:00AM	6:00AM	79-79	"
"	Hammond, Indiana	9:[illegible]AM	12:25PM	83-87	"
"	En route	2:[illegible]PM		90	"
"	Huntington, Indiana	7:40PM	1:05AM	87	"
"	En route	5:[illegible]PM (EST)		84	"
"	Lima, Ohio	7:[illegible]PM		82	"
"	Marion	8:20PM	9:50PM	79-83	"
"	En route		11:30PM	67	"
26	Meadville, Pa.	4:30AM	6:30AM	[illegible]	Overcast
"	En route		8:20AM	69	"
"	Salamanca, N. Y.	9:10AM	10:10AM	72	Light Overcast
"	Cornell	12:30PM	1:35PM	81-85	" "
"	Owego		7:30PM	77	Clear
"	Susquehanna, Pa.	9:15PM	9:30PM	70	"
27	Croxton Yards, N. J.	6:30AM	---	69	Overcast

Total time en route, Bakersfield, California (1:00 AM loading) to arrival at Croxton Yards, New Jersey, 210 hours.

Standing time between arrival of cars in Fresno, California and Croxton Yards, New Jersey, per cent of total time en route, 36.8.

TABLE 5

CALIFORNIA POTATO TRANSPORTATION TEST NO. 6, BAKERSFIELD, CALIF. TO NEW YORK CITY
June 18 - 27, 1 [illegible] SP, UP, C&NW, ERIE.

	Ice Supplied (pounds)						Ice Remaining (pounds)			
CAR	1	2	3	4	5	6	2	3	4	6
PFE	5520	7487	6908	6062	7203	7754	7487	6908	6062	7754
RULE	Std.	247	254	247	Std.	242-240	247	254	247	242-240
PLACE, DATE, TYE										
	ICE SUPPLIED PRIOR TO LOADING (PRECOOLING)									
Bakersfield, Calif. 6/18, 1:00 AM	Dry	Dry	11,500	11,500	Dry	Dry	--	--	--	--
	ICE SUPPLIED AFTER LOADING									
Bakersfield, Calif. 6/19, 12:25 AM	11,500	11,500	3,450	None	Dry	Dry (9,900 Top Ice at Pixley)	--	--	--	--
Fresno, Calif. 6/19, 9:30 AM	1,500	None	None	None	11,500	None	--	--	--	--
Roseville, Calif. 6/19, 10:20 PM	2,400	None	None	None	2,700	11,500	--	--	--	--
Sparks, Nevada 6/20, 1:30 PM	2,400	None	None	None	3,900	None	3,500	5,000	8,000	10,000 1/
Carlin, Nevada 6/21, 3:00 AM	1,600	None	None	None	1,800	None	--	--	--	--
Ogden, Utah 6/21, 4:30 PM	1,100	None	None	None	1,900	None	1,200	2,300	5,500	9,200 2/
Laramie, Wyoming 6/22, 6:30 PM	1,200	11,000	10,000	6,800	1,600	None	500	1,500	4,700	8,500 3/
Council Bluffs, Iowa 6/23, 8:50 PM	900	None	None	None	800	None	-	-	-	-
Clinton, Iowa 6/24, 2:30 PM	1,300	None	None	None	700	None	7,000	9,000	9,000	5,500
Clearing, Illinois 6/25, 6:00 AM	750	None	None	None	700	None	-	-	-	
Marion, Ohio 6/25, 8:35 PM	1,000	None	None	None			5,200	5,200	7,000	4/

ICING RECORD (Continued)

ICE SUPPLIED AFTER LOADING

CAR	1	2	3	4	5	6	2	3	4	6
REF.	6530	7487	6928	6062	7203	7764	7487	6928	6062	7764
RULE	Std.	247	254	247	Std.	242-240	247	254	247	242-240
Hornell, New York	2,200	None	None	None			3,500	3,500	5,500	
Total Ice Supplied:	22,250	22,500	24,950	18,300		21,400				
Ice Remaining Upon Arrival:	10,000	2,500	3,900	3,900		5,300				
Total Ice Used in Transit:	12,250	20,000	21,050	14,400		16,100 5/				

Icing Footnotes:

1/ 2,000 pounds of top ice remaining, covering one third of load, primarily near bunkers.
2/ 1,200 pounds of top ice remaining.
3/ 800 pounds of top ice remaining.
4/ Chicago destination. Ice remaining at 8:00 a.m. 6/25, was 5000 lbs. bunker ice, 300 lbs. of top ice.
5/ Pixley, California to Chicago, Illinois, top ice plus bunker ice.

TABLE 6

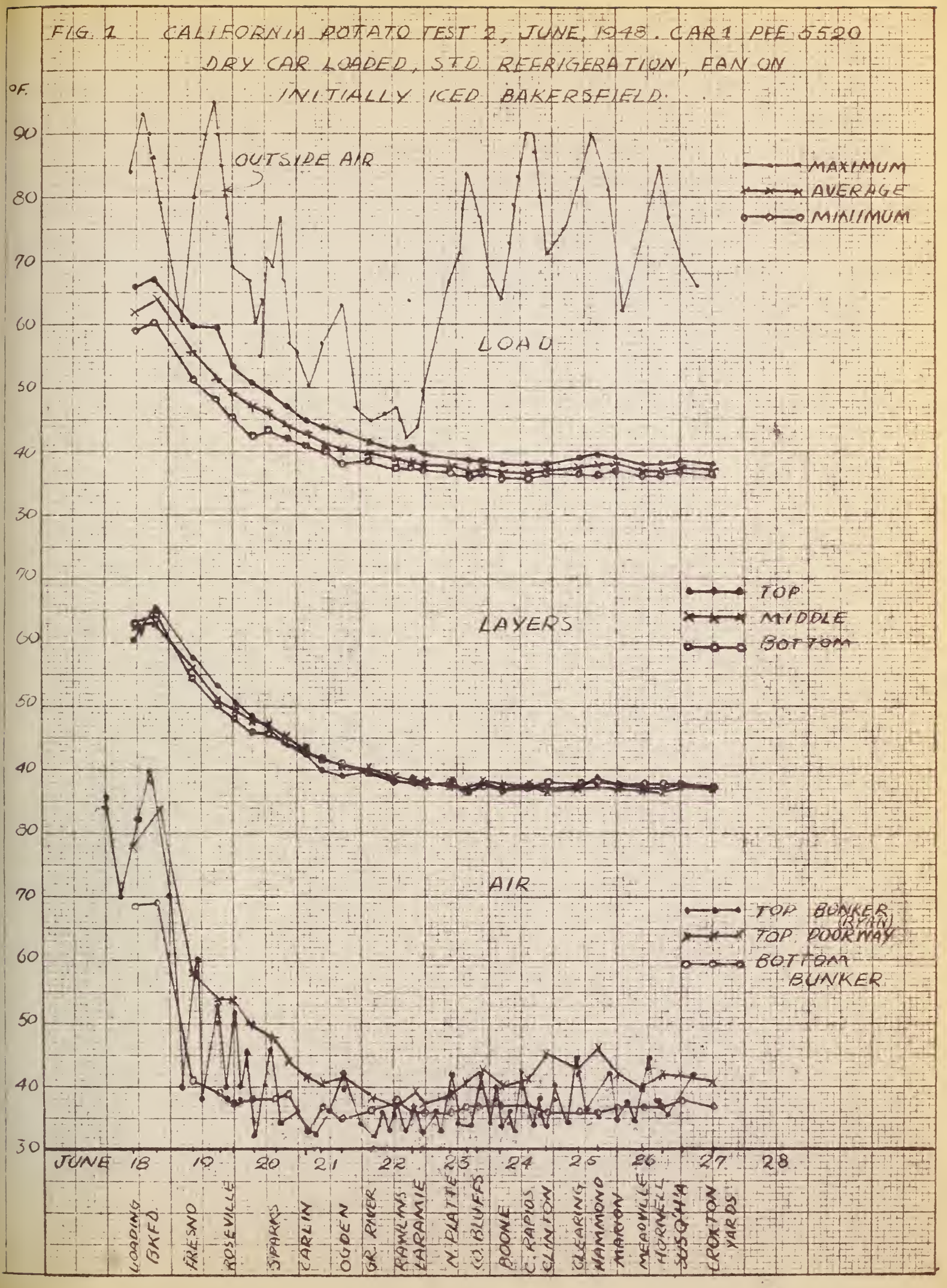
WEIGHT LOSS OF TUBERS (TEST PACKAGES)

Car	Refrigeration	Bag No.	Loaded Weight 6/18	Unloaded in New York			Inspected New York July 1	
				Date	Loss in Wt. Lbs.	Pct.	Loss in Wt. 2/ Lbs.	Pct.
1	Std.	10	53.4	6/28	.6	1.1	1.4	2.6
	Initial Bksfld.	11	50.9		.7	1.4	1.3	2.6
	Fans On	12	50.5		.7	1.4	1.3	2.6
				Average		1.3		2.6
2	247, Initial	7	51.5	6/28	.8	1.6	1.4	2.7
	Bksfld, re-ice	8	54.3		.9	1.7	1.4	2.6
	Laramie, fans on	9	51.3		1.0	1.9	1.6	2.9
				Average		1.7		2.7
3	254, pre-iced,	4	53.2	6/29	.9	1.7	1.3	2.4
	Repl. Bkld, re-ice	5	51.6		.6	1.2	1.3	2.5
	Laramie, fans on	6	56.0		.9	1.6	1.4	2.5
				Average		1.5		2.6
4	247, pre-iced,	1	53.6	6/29	.6	1.1	1.1	2.1
	Re-ice Laramie,	2	54.1		.5	.9	1.4	2.6
	Load precooled, fans off.	3	54.1		.5	.9	.9	1.7
				Average		1.0		2.1
5	Std. Initial	16	52.3	6/29	.9	1.7	1.7	3.2
	Fresno, fans	17	53.9		1.2	2.2	1.5	2.8
	off 1/	18	53.8		.9	1.7	1.4	2.6
				Average		1.9		2.9

1/ Test packages transferred to Car 4 at Chicago

2/ Loss in weight after 2 to 3 days at 85° F.

FIG. 1 CALIFORNIA POTATO TEST 2, JUNE, 1948. CAR 1 PFE 5520
DRY CAR LOADED, STD. REFRIGERATION, FAN ON
INITIALLY ICED BAKERSFIELD.



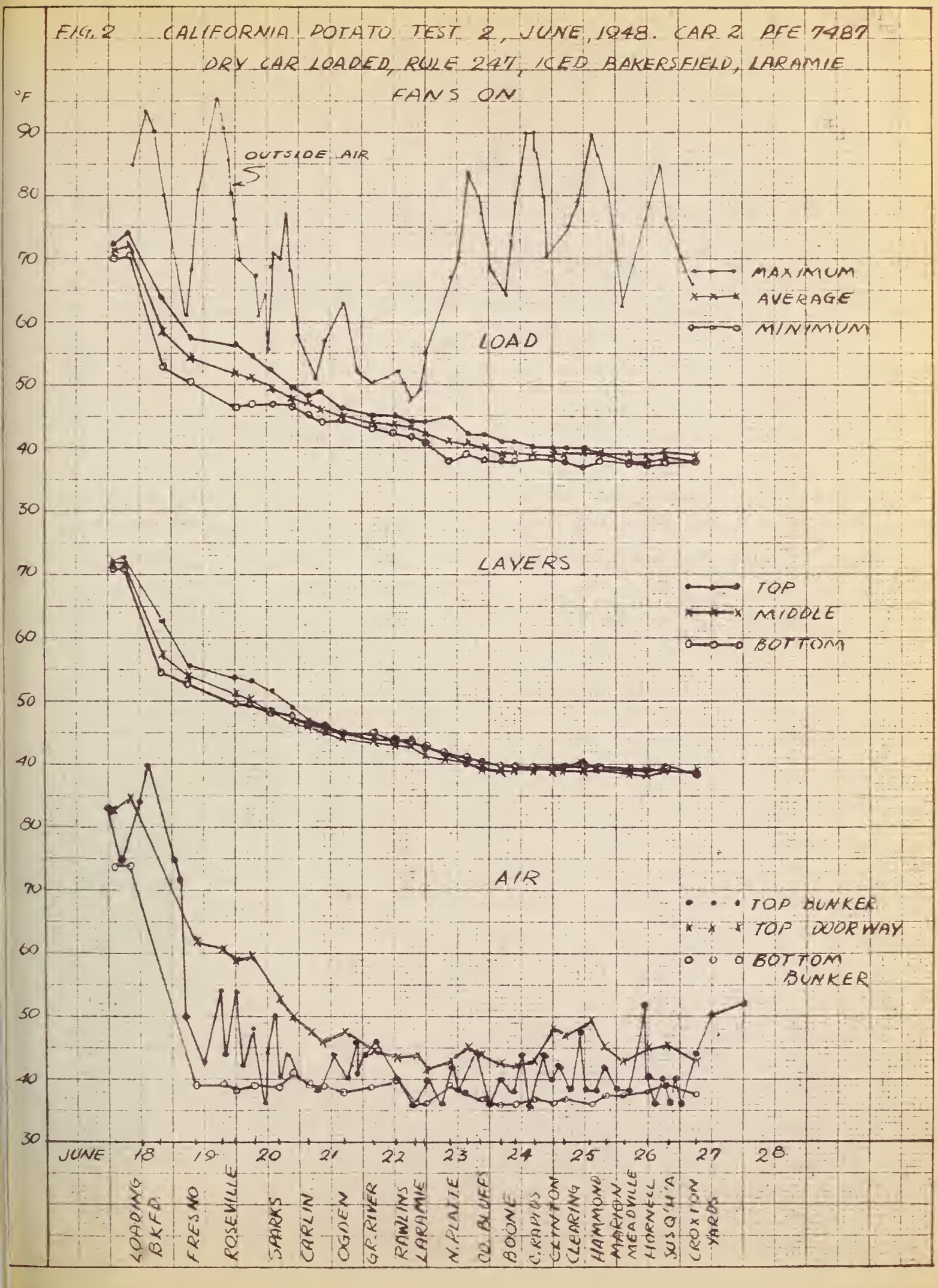


FIG. 2 CALIFORNIA POTATO TEST 2, JUNE, 1948. CAR 2 PFE 7487
DRY CAR LOADED, RULE 247, ICED BAKERSFIELD, LARAMIE
FANS ON
°F
OUTSIDE AIR
LOAD
MAXIMUM
AVERAGE
MINIMUM
LAYERS
TOP
MIDDLE
BOTTOM
AIR
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
JUNE
18
19
20
21
22
23
24
25
26
27
28
LOADING BKFD.
FRESNO
ROSEVILLE
SPARKS
CARLIN
OGDEN
GR. RIVER
RAWLINS
LARAMIE
N. PLATTE
CO. BLUFFS
BOONE
C. RAPIDS
CLINTON
CLEARING
HAMMOND
MARION
MEADVILLE
HORNELL
SUSQ'H'A
CROXTON YARDS

FIG. 3 CALIFORNIA POTATO TEST 2. JUNE 1948. CAR 3 PFE 6928.
RULE 254, PRE-ICED, REPLENISHED BAKERSFIELD, RE-ICE
LARAMIE. FANS ON.

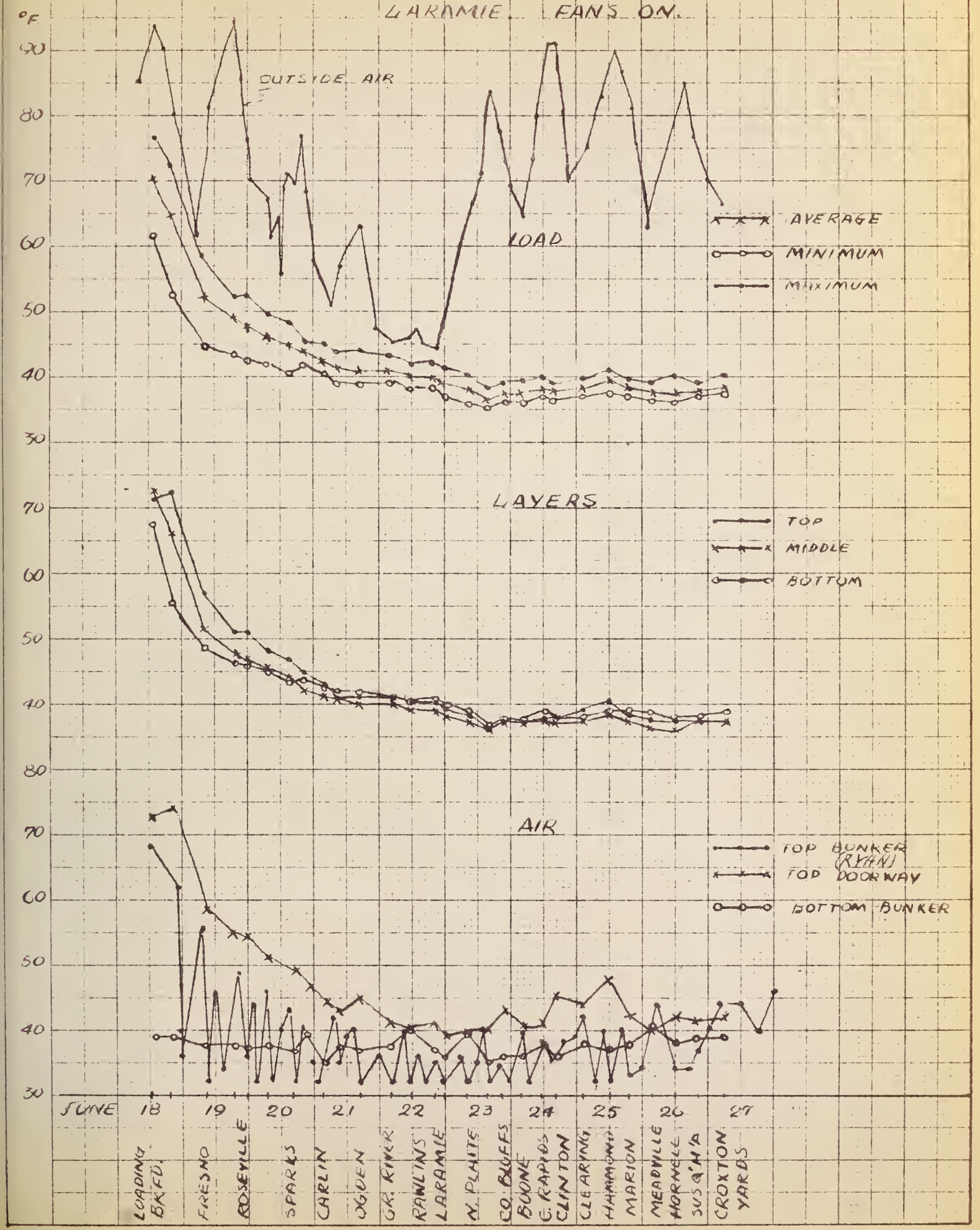


FIG. 4. CALIFORNIA POTATO TEST 2. JUNE 1948. CAR 4. PFE 6062.
RULE 247 PRE-ICED, RE-ICE LARAMIE. FANS OFF.
POTATOES PRECOOLED IN ICE WATER.

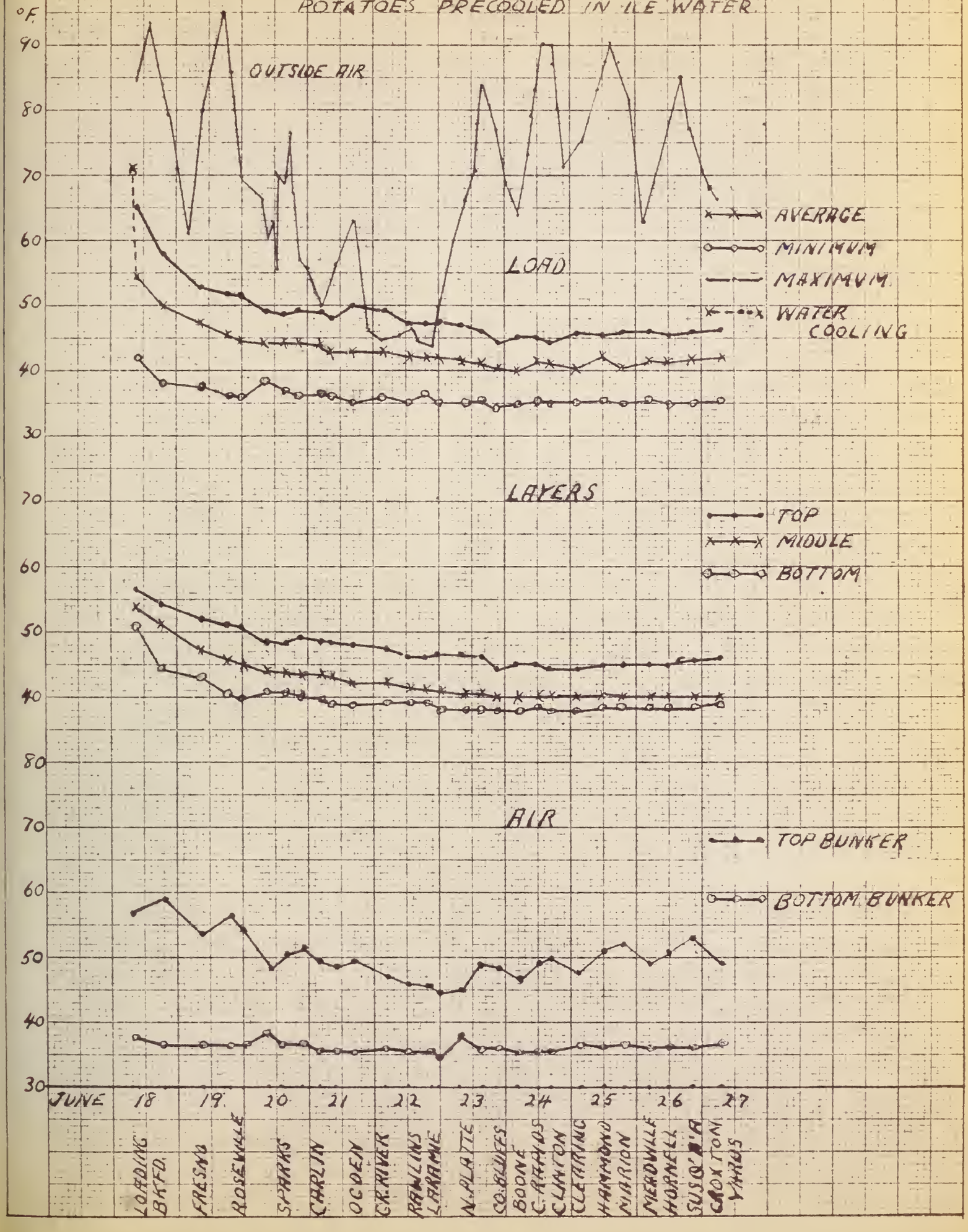


FIG. 5 CALIFORNIA POTATO TEST 2, JUNE 1948. CAR 5, PFE 7203

DRY CAR LOADED, STD. REFRIG., FANS OFF

INITIALLY ICED FRESNO, CALIF.

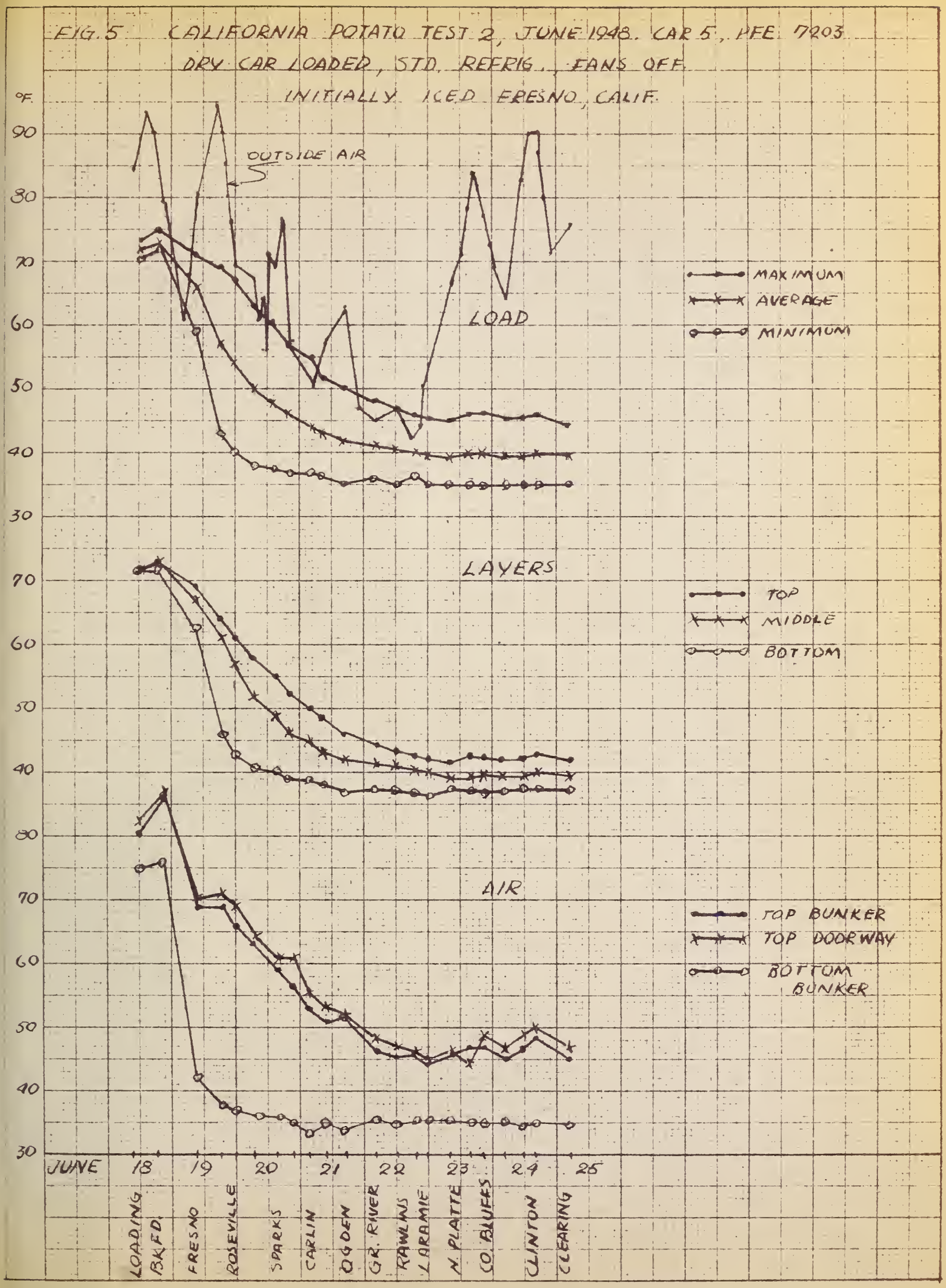


FIG. 6 CALIFORNIA POTATO TEST 2, JUNE 1948. CAR 6, PFE 7764
DRY CAR LOADED, RULE 240, INITIALLY ICED ROSEVILLE
TOP ICED AFTER LOADED WITH 9,900
POUNDS CRUSHED ICE. FANS OFF TO N. PLATTE.

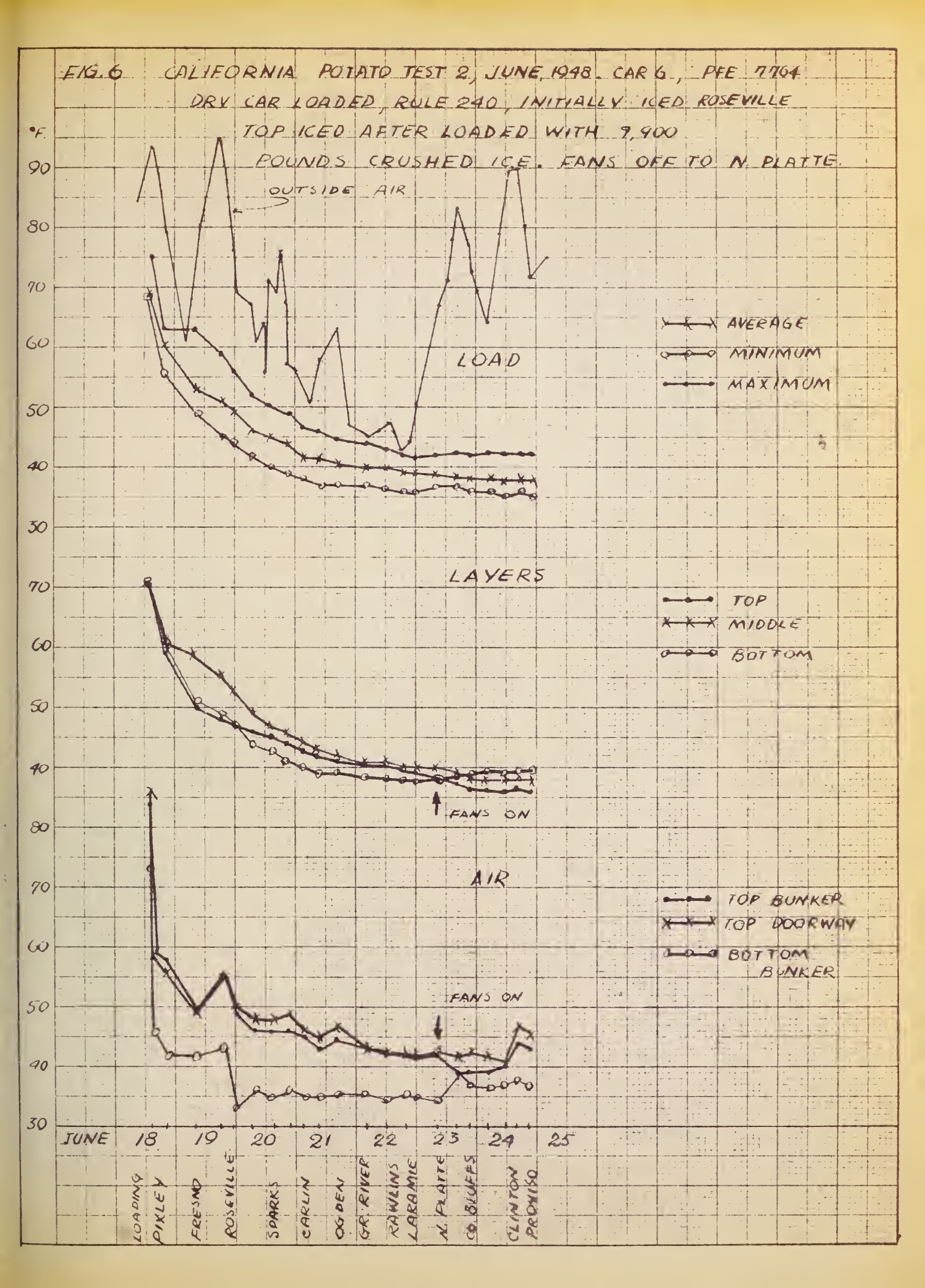
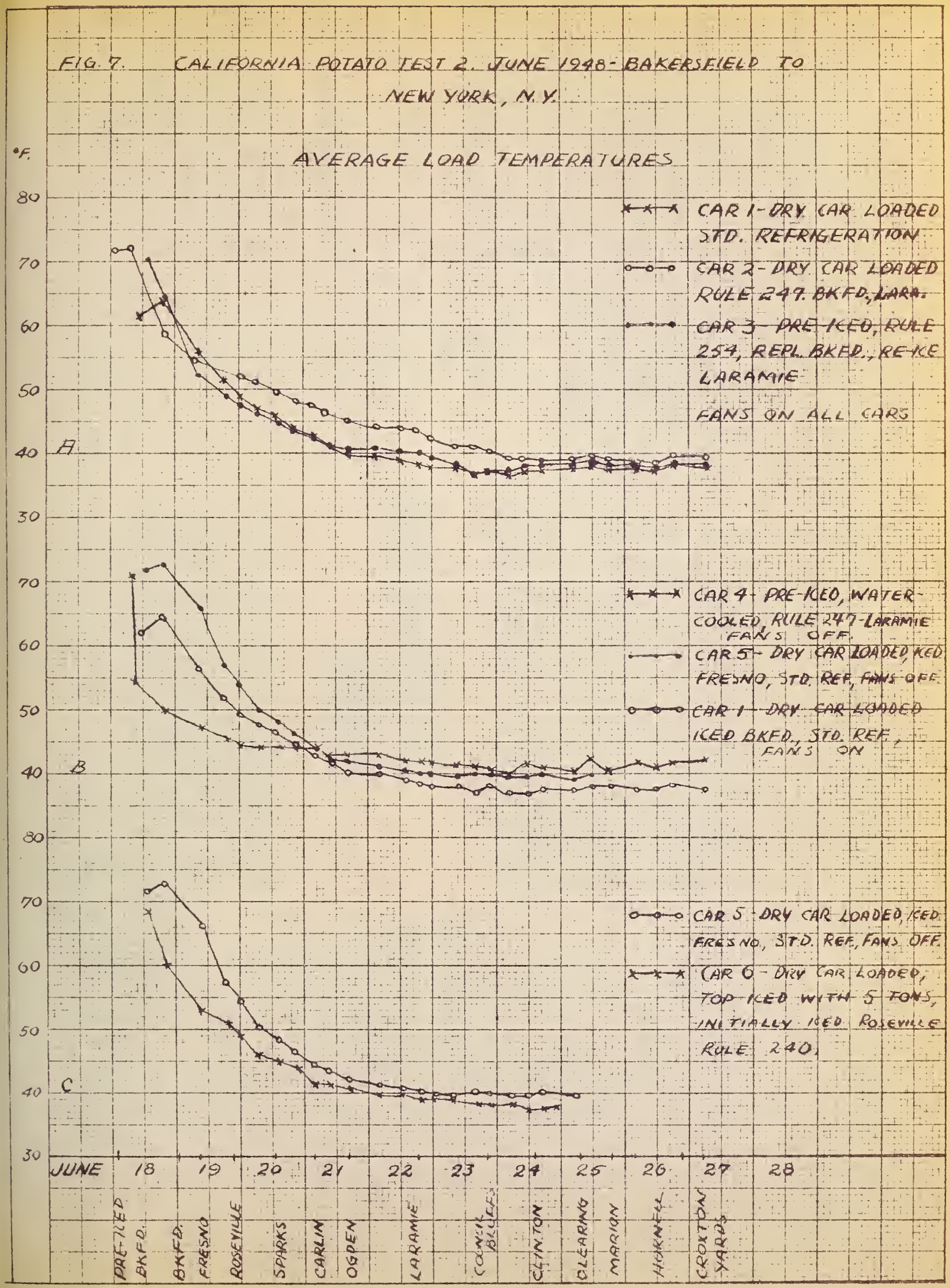


FIG. 7. CALIFORNIA POTATO TEST 2. JUNE 1948 - BAKERSFIELD TO NEW YORK, N.Y.


AVERAGE LOAD TEMPERATURES
°F.
80
70
60
50
40
30
A
B
C
CAR 1 - DRY CAR LOADED STD. REFRIGERATION
CAR 2 - DRY CAR LOADED RULE 247. BKFD., LARA.
CAR 3 - PRE-ICED, RULE 254, REPL. BKFD., RE-ICE LARAMIE
FANS ON ALL CARS
CAR 4 - PRE-ICED, WATER-COOLED, RULE 247 - LARAMIE FANS OFF.
CAR 5 - DRY CAR LOADED, ICED FRESNO, STD. REF., FANS OFF.
CAR 1 - DRY CAR LOADED ICED BKFD., STD. REF., FANS ON
CAR 5 - DRY CAR LOADED, ICED FRESNO, STD. REF., FANS OFF.
CAR 6 - DRY CAR LOADED, TOP ICED WITH 5 TONS, INITIALLY ICED ROSEVILLE RULE 240.
JUNE 18 19 20 21 22 23 24 25 26 27 28
PRE-ICED BKFD.
BKFD. FRESNO
ROSEVILLE
SPARKS
CARLIN
OGDEN
LARAMIE
COUNCIL BLUFFS
CLINTON
CLEARING
MARION
HORNELL
CROXTON YARDS